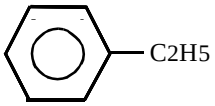
ETHYL BENZENE

Ethyl benzene is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 100-41-4

Molecular Formula: C_8H_{10}



Ethyl benzene is a colorless, flammable liquid with an aromatic odor. It is practically insoluble in water and is soluble in alcohol, carbon tetrachloride, ether, and other organic solvents. Ethyl benzene evaporates about 94 times more slowly than ether (HSDB, 1991).

Physical Properties of Ethyl benzene

Synonyms: phenylethane

Molecular Weight:	106.16
Boiling Point:	136.2 °C
Melting Point:	-94.97 °C
Flash Point:	18 °C (closed cup)
Vapor Density:	3.66 (air = 1)
Vapor Pressure:	9.53 mm Hg at 25 °C
Density/Specific Gravity:	0.867 at 20/4 °C (water = 1)
Log Octanol/Water Partition Coefficient:	3.15
Conversion Factor:	1 ppm = 4.34 mg/m^3

(Howard, 1990; HSDB, 1991; Merck, 1989; Sax, 1987; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Ethyl benzene is used as an intermediate in the production of styrene and as a solvent in paint and other consumer products. Ethyl benzene is also used in petroleum refining. Ethyl benzene has been detected in auto emissions and cigarette smoke (Howard, 1990).

The primary stationary sources that have reported emissions of ethyl benzene in California are manufacturers of aircraft and parts, petroleum refining, and manufacturers of miscellaneous plastics products (ARB, 1997b). Ethyl benzene has also been detected but not quantified in motor vehicle exhaust by the Air Resources Board (ARB) (ARB, 1995e).

B. Emissions

The total emissions of ethyl benzene from stationary sources in California are estimated to be at least 140,000 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Ethyl benzene is a component of crude oil (HSDB, 1991).

AMBIENT CONCENTRATIONS

Ethyl benzene is routinely monitored by the statewide ARB air toxics network. The network's mean concentration of ethyl benzene from January 1996 through December 1996 is estimated to be 1.61 micrograms per cubic meter ($\mu g/m^3$) or 0.37 parts per billion (ppb) (ARB, 1997c).

The United States Environmental Protection Agency (U.S. EPA) has also compiled ambient concentration data from several studies throughout the United States. Data from 11 United States cities during 1990 reported an overall mean concentration of 1.68 $\mu g/m^3$ (0.39 ppb) (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

Ethyl benzene is a chemical solvent found in many consumer products such as paint and cleaning products. However, ethyl benzene comprises less than 10 percent by weight of the product ingredients in these products (Sack and Steele, 1989).

Ethyl benzene was measured in Los Angeles homes during winter and summer seasons in the 1987 Total Exposure Assessment Methodology study (Pellizzari et al., 1989). The mean indoor concentrations of ethyl benzene were 5.02 to 6.64 $\mu g/m^3$ and 2.48 to 3.03 $\mu g/m^3$ for winter and summer, respectively. In contrast, the mean outdoor concentrations of ethyl benzene were 4.58 $\mu g/m^3$ and 1.61 $\mu g/m^3$ for winter and summer, respectively.

In a study of east coast public buildings, the average indoor concentrations of ethyl benzene ranged from 3.6 to 6.8 $\mu g/m^3$ (Sheldon et al, 1988a). In other public buildings, the mean concentrations of ethyl benzene for most of the indoor environments ranged from 1.01 to 10.15 $\mu g/m^3$ except for a new office with a high mean concentration of 51.26 $\mu g/m^3$ (Sheldon et al, 1988b).

Studies in Raleigh, North Carolina and Boston, Massachusetts measured average in-vehicle concentrations of ethyl benzene of 5.8 $\mu g/m^3$ and 8.8 $\mu g/m^3$ and maximum concentrations of

21.6 $\mu g/m^3$ and 21.8 $\mu g/m^3$, respectively; about 3 to 5 times greater than what was measured in the ambient air (Chan et al., 1991a; Chan et al., 1991b).

ATMOSPHERIC PERSISTENCE

The only important chemical loss process for ethyl benzene in the troposphere is by the reaction with the hydroxyl (OH) radical. The calculated half-life and lifetime of ethyl benzene due to reaction with the OH radical are 1.4 days and 2.0 days, respectively. The reaction products are expected to include ethylphenols, acetophenone, glyoxal, ethylglyoxal, and other ring-opened products (Atkinson, 1995). Its reaction products include glyoxal, ethylglyoxal, acetophenone, formaldehyde, and acetaldehyde (Kao, 1994).

AB 2588 RISK ASSESSMENT INFORMATION

Although ethyl benzene is reported as being emitted in California from stationary sources no health values (cancer or non-cancer) are listed in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines for use in risk assessments (CAPCOA, 1993).

HEALTH EFFECTS

Probable routes of human exposure to ethyl benzene are inhalation and ingestion (HSDB, 1991).

Non-Cancer: Ethyl benzene is a central nervous system depressant at high levels of exposure. Ethyl benzene is also irritating to the eyes and respiratory tract. Animal studies have shown effects on the blood, liver and kidneys from chronic inhalation exposure to ethyl benzene (U.S. EPA, 1994a). Persons with existing skin disorders, liver, kidney, nervous system, blood and hemopoietic-organ disorders, and women with ovulation and menstrual cycle disorders may be more susceptible to adverse effects (HSDB, 1991).

The U.S. EPA has established a Reference Concentration (RfC) of 1 milligram per cubic meter for ethyl benzene based on developmental toxicity in rats and rabbits. The U.S. EPA estimates that inhalation of this concentration or less, over a lifetime, would not likely result in the occurrence of chronic, non-cancer effects. The U.S. EPA has established an oral Reference Dose (RfD) of 0.1 milligrams per kilogram per day for ethyl benzene based on liver and kidney toxicity in rats. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, will not result in the occurrence of chronic, non-cancer effects (U.S. EPA, 1994a).

No adverse human reproductive information is available. Adverse effects in fetal development have been reported in animal inhalation studies (U.S. EPA, 1994a).

Cancer: Limited and inconclusive data are available regarding the carcinogenic effects of ethyl benzene in humans and animals. The U.S. EPA has classified ethyl benzene as Group D: Not classifiable as to human carcinogenicity (U.S. EPA, 1994a). The International Agency for Research on Cancer has not classified ethyl benzene as to its carcinogenicity (IARC, 1987a).